Toward a Sustainable Textile Value Chain

--Case Study Report on the Certification Practice of Ecological Textile Technical Specifications in China's Textile Industry

China Environmental United Certification Center

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Project Team Members

China Environmental United Certification Center Co., Ltd. – Cui Xiaodong (Project Leader)

China Environmental United Certification Center Co., Ltd. – Cao Jing

China Environmental United Certification Center Co., Ltd. – Lei Yuxin

China Environmental United Certification Center Co., Ltd. – Chen Yiqun

China Environmental United Certification Center Co., Ltd. – Hou Rong

China Environmental United Certification Center Co., Ltd. – Li Ren

China Environmental United Certification Center Co., Ltd. – Shen Na

China Environmental United Certification Center Co., Ltd. – Jing Kun

China Environmental United Certification Center Co., Ltd. – Yang Lu

Experts

Qingdao Product Quality Testing Research Institute – Li Huanting

Nanjing Customs Textile Industrial Products Testing Center – Ji Xiaodan

Qingdao Product Quality Testing Research Institute – Yuan Tian

Nanjing Customs Textile Industrial Products Testing Center – Wei Feng

Wuxi Textile Industry Association – Zhang Hong

National Advanced Printing and Dyeing Innovation Center – Liu Yongjie

Oeko-Institut e.V. – Siddharth Prakash

Oeko-Institut e.V. – Clara Löw

Oeko-Institut e.V. – Katja Moch

Oeko-Institut e.V. – Viviana López

United Nations Environment Programme (UNEP) – Laetitia Montero

United Nations Environment Programme (UNEP) – Sophia Leticia Groll

United Nations Environment Programme (UNEP) – Bruna De Moraes Tiussu

United Nations Environment Programme (UNEP) China Office – Liu Sijia

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--Case Study Report on the Certification Practice of Ecological Textile Technical Specifications in China's Textile Industry

1、 Executive Summary

This report presents a case study on the certification practice of ecological textile technical specification, examining its role in driving the green transition and fostering a sustainable value chain within China's textile industry. Confronted with the escalation of global green trade requirements and the strategic guidance of domestic "Dual-carbon" goals, China's textile industry urgently requires systematic transformation guidance. In response, the project consortium conducted comprehensive research encompassing the industrial landscape, policies, standards, and enterprise practices, resulting in a detailed *Textile Industry Research Report*. This report identifies key areas for improvement in green management, carbon planning, chemical control, and standard coverage, proposing the development of ecological textile specifications integrating multi-dimensional attributes. Building on this analysis and employing a value chain perspective, the project developed the *Technical Specification for Eco-product Certification - Textile Product* and implemented pilot certifications with three representative enterprises.

The project pursued three core objectives: establishing a scientific specification, promoting its practical application, and training private and public procurers to use the technical specification. The technical specification is structured around a Life Cycle Assessment (LCA) framework, incorporates value chain management principles, and systematically addresses indicators related to climate change, biodiversity, pollution control, and social impacts. It aligns with existing Chinese standards, forming a comprehensive requirement system covering organizational management, product attributes, and supply chain

collaboration.

Through the dissemination of the technical specification and implementation of pilot activities, the understanding of life cycle management and green value chain transformation among participating enterprises, **including SMEs**, has been enhanced by the project. It has facilitated the initial development of strategic frameworks and action plans for green, low-carbon development, marking a substantive step toward industry-wide transition. Future efforts will focus on expanding the technical specification's application, deepening international cooperation, and establishing a long-term mechanism for sustainable industry development.

2、 Project Background and Objectives

2.1 Project Background

In the context of deepening global climate governance, the green development of the textile industry is pivotal for both competitiveness and ecological sustainability. Establishing and implementing an ecological textile technical specification and certification system is a critical pathway to drive this green transition and reshape the value chain. Internationally, stringent green compliance requirements and sustainable procurement policies are restructuring the global textile supply chain. Domestically, China's "2030/2060 goals" provide clear policy direction and binding constraints for the industry's green transformation. As a leading global textile producer with a comprehensive industrial system, greening the sector is essential for maintaining international competitiveness and achieving high-quality domestic development.

To advance this transformation systematically, this study employs value chain analysis, focusing on ecological textile technical specification certification to explore its role and impact in building a sustainable textile value chain, providing actionable insights for the industry.

2.2 Project Objective

(1) To guide the green and low-carbon transformation of the textile industry by developing scientific ecological textile product technical specifications that enrich and elevate relevant requirements.

(2) To promote sustainable procurement (business-to-business) along the textile value chain in China by utilizing the developed sustainability criteria.

(3) To promote sustainable public procurement for textile products in China by influencing suppliers and purchasers through the application of these sustainability criteria.

3、 Development, Core Content, and Innovations of the Technical Specifications

As a phased outcome of the *Consumer Information Programme* and the *EcoAdvance Project*, CEC, in collaboration with Qingdao Institute of Product Quality Inspection (QTC), Textile and Industrial Products Testing Center of Nanjing Customs (JTC), and Wuxi Textile Industry Association, has jointly developed the *Technical Specification for Eco-product Certification – Textile Product*.

The *EcoAdvance project* is a collaborative effort between the United Nations Environment Programme (UNEP), GIZ, and Oko-Institut, receiving financial support from the German Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety (BMUKN) through the International Climate Initiative (IKI).

3.1 Core Methodology

The technical specification is fundamentally based on a Life Cycle Assessment (LCA) approach, encompassing the entire textile value chain from raw material cultivation to finished product. The methodology is

designed to support the project's green transition and sustainable procurement objectives. It focuses on key concerns throughout the product life cycle—human health, climate change, biodiversity protection, and pollution prevention—systematically incorporating dimensions such as raw material traceability, low-carbon production, circularity, and corporate social responsibility. From a value chain perspective, the specification defines sustainable technical requirements for each stage, guiding suppliers to optimize processes and encouraging purchasers to prioritize green products, thereby facilitating practical green transformation and promoting systematic sustainable public procurement in China.

3.2 Core content

The technical specification establishes an evaluation framework with two dimensions: organizational management and product requirements (Figure 1). It quantifies and assesses the overall ecological impact of textiles from source to disposal, focusing on core attributes including resources, energy, low-carbon, biodiversity, and health & safety.

3.2.1 Organizational Management Requirements

This section requires enterprises to establish and operate a sustainable management system, including mechanisms for supplier qualification and evaluation. Carbon management is mandated, requiring GHG accounting and disclosure per ISO 14064-1, alongside the development of emission reduction plans. A chemical management system must ensure closed-loop control from transport to disposal, prohibiting substances listed in *China's Catalog of Strictly Restricted Toxic Chemicals*. Regular supply chain training is required to foster a transparent, traceable, and low-risk supply chain ecosystem.

3.2.2 Product Requirements

The technical specification sets limits for over a hundred hazardous substances, with stricter controls on emerging pollutants (e.g., free formaldehyde, phthalates, PFCs, PAHs) in infant textiles to protect consumer health. For biodiversity, it includes provisions on the proportion of organic cotton, pesticide use in natural fibers, reduction of micro-fiber release, and surfactant biodegradability.

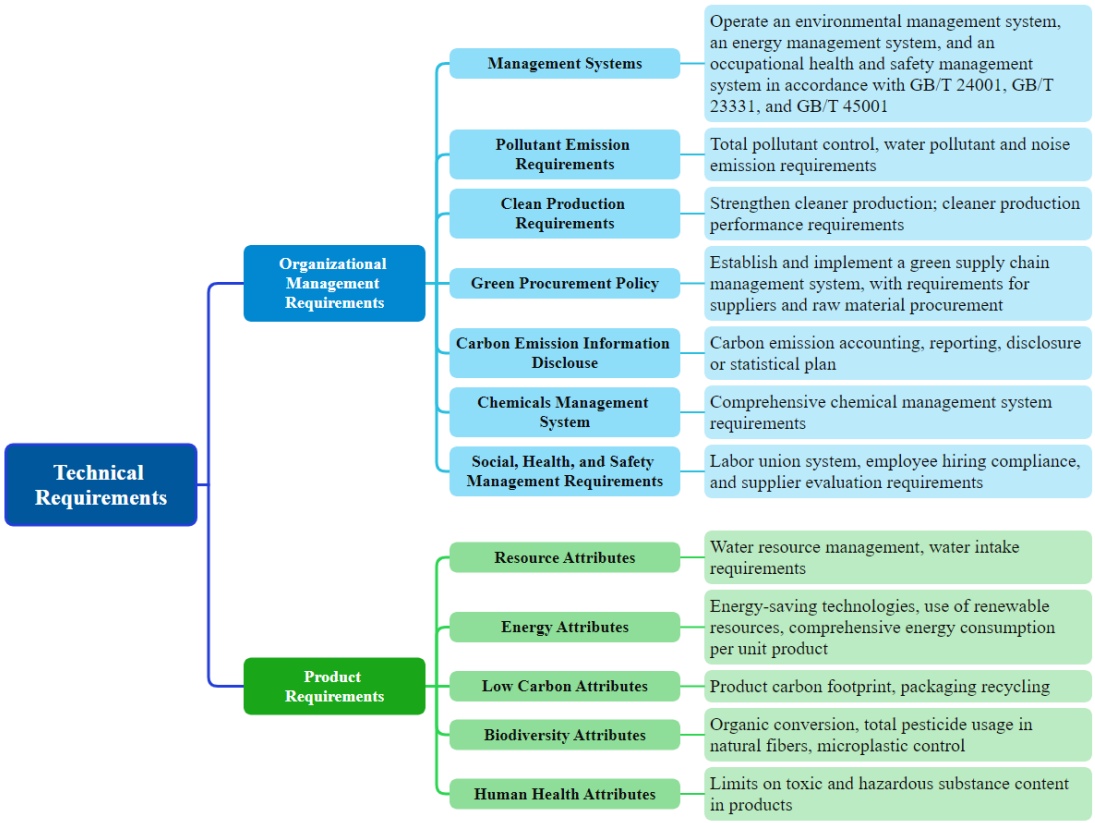


Figure 1. Core Structure of the Technical specification

3.3 Innovations and Distinctive Features

The innovativeness of this technical specification lies not only in its technical rigor but also in its systemic conceptual and methodological approach:

(1) Systematic Implementation of Life Cycle Management

This technical specification is the first to fully integrate all life cycle stages—design, procurement, production, use, and recycling—into a certification system. It establishes a green closed-loop approach, moving

beyond the traditional focus on end products alone.

(2) Explicit and Quantifiable Integration of Biodiversity Protection

The technical specification pioneers the inclusion of biodiversity impact, translating the abstract goal into concrete, measurable, and auditable production constraints through indicators like organic fiber certification and chemical biodegradability.

(3) "Chain-Radiation" Responsibility Transmission Mechanism

It proposes a model where core enterprises act as fulcrums, radiating green requirements upstream and downstream through embedded compliance, transparency, and collaborative training, driving holistic ecological performance improvement across the chain.

(4) Development of a "Globally Aligned, Locally Adapted" Technical Specification

By benchmarking international technical specifications while deeply integrating China's industrial context and policy direction, it offers a certification system with global relevance and localized applicability, presenting a referable "China Solution."

4、 Promotion, Adoption, and Market Response of the Technical Specifications

A systematic, phased promotion strategy was implemented to facilitate the adoption of the *Technical Specification for Eco-product Certification – Textile Product*, including pilot certifications that effectively stimulated market engagement.

4.1 Overview of Promotion Activities

Promotion was conducted in three progressive phases:

Phase 1: Technical specification Introduction and Launch. Aligned

with the EcoAdvance project, an introductory seminar was held on May 27th for value chain stakeholders, explaining the technical specification's background, policies, core criteria, and procedures, laying the initial groundwork.

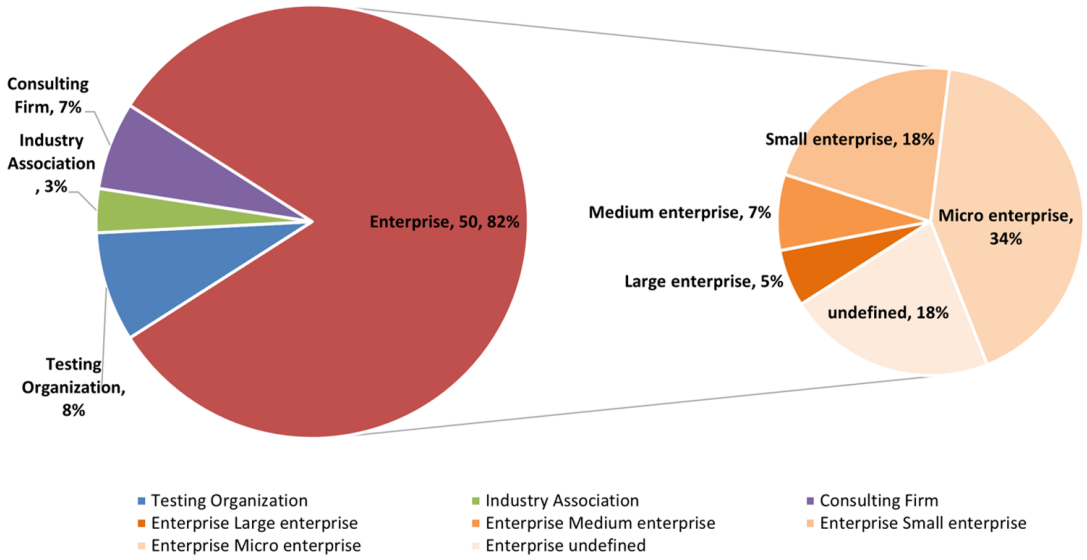
Phase 2: Technical specification Release and Promotional Signing. A conference themed "Ecolabels Empowering Green Transformation" was held to discuss their role in industry transition. It detailed the technical specification's life cycle and supply chain frameworks and secured agreements with four enterprises to launch the first certification practices, marking its transition from text to action.

Phase 3: Deepening Industry Outreach. Building on momentum, promotion extended to local clusters. In September, a dedicated session during Qingdao's "Quality Month" activities targeted local enterprises and buyers, significantly raising awareness and application interest within the industrial base.

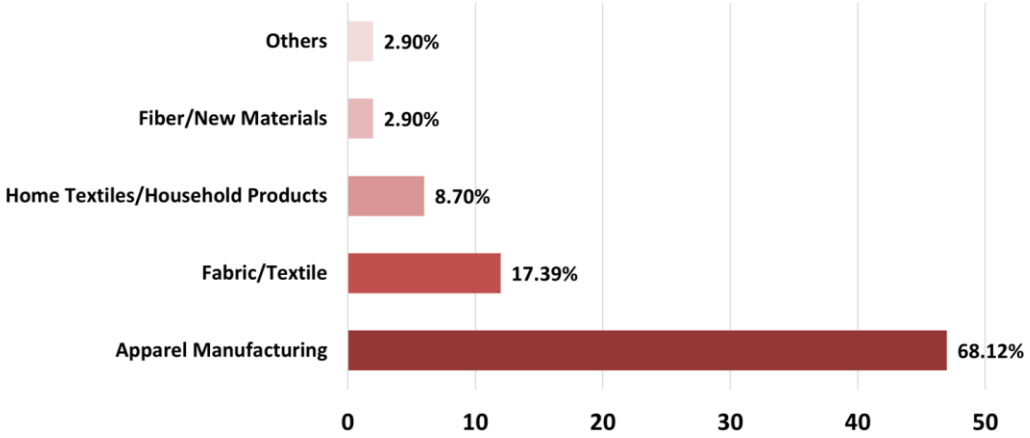
4.2 Market Interest and Application Status

4.2.1 Market Interest

Of the 62 relevant stakeholders who attended the "Technical Specification Release and Promotional Signing" conference held in Qingdao on June 19, 80% were textile manufacturers covering mid-stream and downstream segments, indicating full-chain engagement (Figure 2). Notably, 68% were apparel manufacturers, aligning well with the technical specification's life-cycle and supply-chain focus, providing a solid foundation for implementation.



（a）the Type of Enterprises Participating in Promotion Meetings



（b）the Classification of Textile Enterprises Participating in Promotion Meetings

Figure 2 Distribution and Classification of Attending Enterprises in the Value Chain

According to the textile classification method in the technical specification, 50 enterprises were divided into three categories: "Textile products with direct contact to skin", "Textile products without direct contact to skin", and "Textile products for infants" (repeated statistics allowed for enterprises with cross-category production, as shown in Figure 3). The classification results directly reflect the core product scenarios that the technical specification needs to cover. To further accurately match the promotion scenarios of the technical specification, enterprises in the direct and non-direct contact categories were subdivided by specific products to

clarify the adaptation needs of different products, as shown in Figure 4 (a) and (b) (only 5 infant product enterprises, so no specific subdivision).

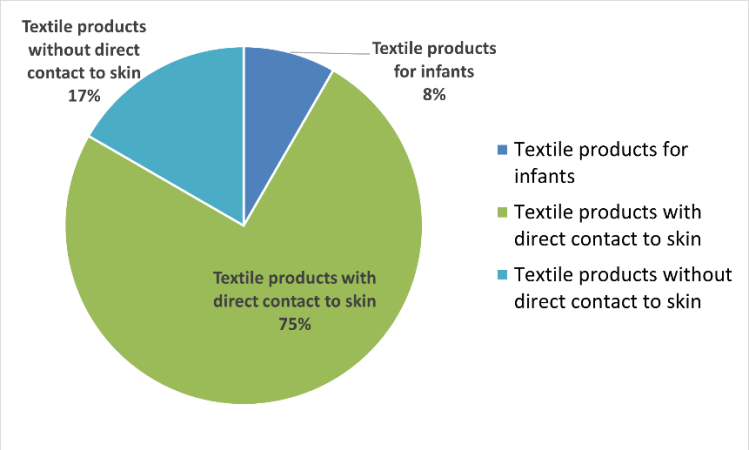
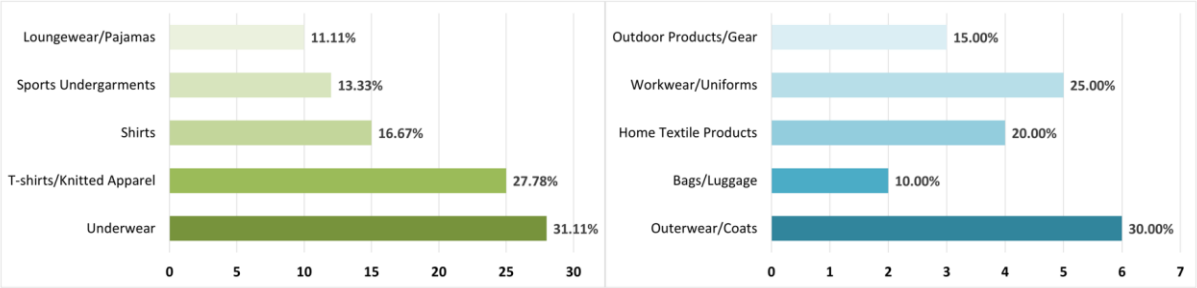


Figure 3. Classification of Interested Enterprises



（a）Textile products with direct contact to skin enterprises （b） Textile products without direct contact to skin enterprises

Figure 4. Sub-classification of Direct and Non-Direct Contact Product Enterprises

Enterprises producing textile products with direct contact to skin accounted for an absolute majority (75%), reflecting that the participating enterprises' products are mainly for consumers' close-fitting use scenarios. Although accounting for a low proportion, enterprises producing textile products without direct contact to skin are mostly high-end garments such as coats and suits or home textile products with high brand awareness, and their production processes are more adaptable to "full-life-cycle control and low-carbon requirements". Infant product enterprises are small in scale but have the strictest safety technical specifications, serving as an important demonstration scenario for the technical specification's "high-standard leadership", but are not suitable as the first batch of pilots due to single product categories. The 15 cross-category production enterprises, with

their full-chain production characteristics, have high compatibility with the "green supply chain collaboration" technical requirements, becoming the core selection scope for the first batch of certification practice intending enterprises.

4.2.2 Pilot Enterprise Status

Based on the research on intending enterprises, three influential garment enterprises in China's textile industry were selected for pilot certification. These three enterprises have clear strategic layouts and solid foundations in the green and low-carbon development of the textile industry, and participated in the research work in the early stage of the project, having a deep understanding of the project.

HLA Group Corp., Ltd. is a large-scale garment group, which boasted a registered capital of RMB 48.028 billion, generated operating revenue of RMB 20.957 billion, and operated over 5,000 stores nationwide in 2025. The company has earned several prestigious honors, including National Green Factory and Excellent Intelligent Factory. Its complete supply chain system aligns with the requirements of "full-life-cycle control," enabling it to guide the mass consumer market toward green transformation. As a high-end garment brand focusing on business formal wear. **Baoxiniao Holding Co., Ltd.** generates annual retail revenue of over RMB 5 billion and is ranked among the top 100 enterprises in China's garment industry, with a notably high proportion of its products being exported. Adhering to the concept of sustainable development, the company prioritizes the use of environmentally friendly raw materials such as corn fiber, organic cotton, and recycled fiber in the production process, and is committed to reducing pollutant and industrial waste emissions while improving resource utilization efficiency. **Shanghai Baoniao Garment Co., Ltd.** operates three major industrial parks located in Shanghai Songjiang, Anhui Hefei, and Zhejiang Yongjia, covering a total area of 400 acres. With over 3,500 highly skilled production and management staff and 10 world-class fully

automated production lines for suits and shirts, the company has an annual output of more than 4.7 million sets of high-end men's and women's suits and 4.3 million premium shirts. As a top 10 enterprise in China's high-end business custom wear industry, Baoniao adopts eco-friendly raw and auxiliary materials in product R&D, has earned multiple green product and supply chain certifications, utilizes energy-saving intelligent equipment in production, implements waste recycling and heat recovery systems, and has established an integrated 5G smart green factory.

5、 Case Studies of Pilot Enterprise Certification

5.1 Project Implementation Status

5.1.1 Project Scope

Certification Scope: Textile products with direct contact to skin (shirts, trousers, skirts, etc.) and textile products without direct contact to skin (suits, coats, cotton-padded clothes, etc.).

Audit Venues: Management, functional departments, and production workshops of the three enterprises.

5.1.2 Audit Process

Audits and sampling were conducted per the technical specification, focusing on raw material traceability, clean production compliance, carbon footprint accounting, hazardous substance control, and Corporate Social

Responsibility (CSR) Implementation fulfillment.

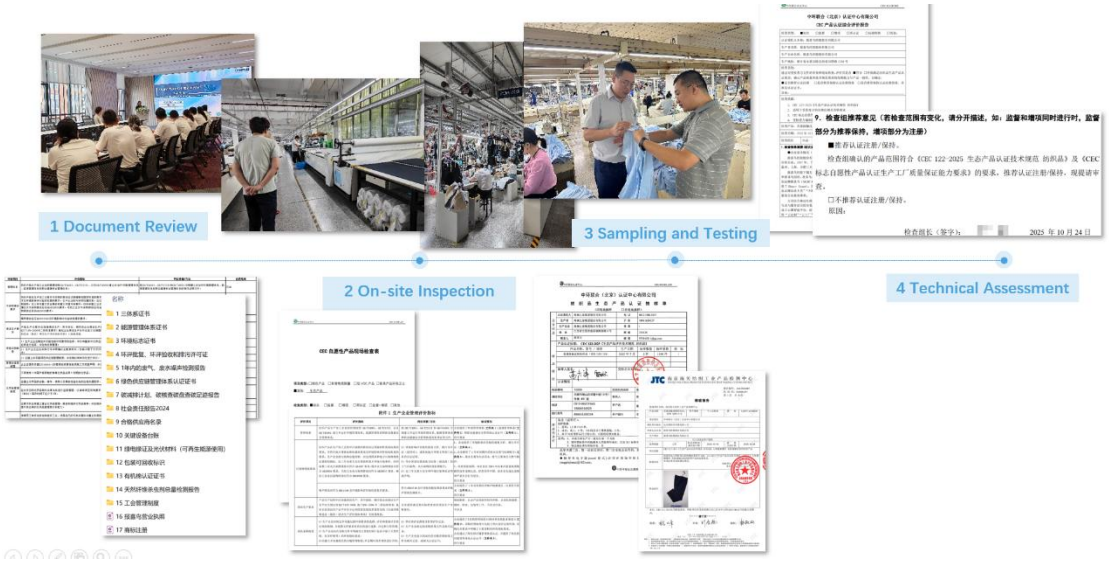


Figure 5. Certification Implementation Flowchart

5.1.3 Enterprise Improvements and Outcomes

The certification work for the pilot enterprises has progressed steadily and achieved phased results. To date, all three enterprises have successfully completed the first round of certification reviews and obtained ecological textile certificates. Guided by this technical specification, the pilot enterprises have not only established systematic plans for carbon emission reduction and operational aspects but have also made substantial adjustments and improvements in areas such as biodiversity protection and social responsibility fulfillment.

At the low-carbon level, all three enterprises have announced quantified medium- to long-term emission reduction targets and implementation pathways: HLA Group Corp., Ltd. has specified that by 2030, the carbon emission intensity per unit product will be ≤4.35 kg CO_2e/set, aiming to achieve full-scope carbon neutrality by 2050; Baoxiniao Holding Co., Ltd. has committed to reducing its Scope 1&2 absolute greenhouse gas emissions by 63% by 2035 compared to 2024 levels; Shanghai Baoniao Garment Co., Ltd. continues to advance its annual carbon neutrality goals.

To achieve these targets, the enterprises have established internal carbon management mechanisms, conducted greenhouse gas accounting, and utilized technologies such as AI to optimize supply chain emission monitoring.

In terms of biodiversity protection, the relevant pilot enterprises have actively adjusted their procurement and production practices to comply with regulatory requirements. All three pilot enterprises strictly control pesticide content in natural fibers, having established procurement management systems. Through on-site inspections and verification of actual product test reports, the total pesticide content was confirmed not to exceed the limits specified in the standard. To reduce microfiber release, Shanghai Baoniao and Baoxiniao have specifically introduced process optimization measures such as CAD layout and fully automatic computerized cutting beds, effectively minimizing waste and microfiber generation at the source.

Regarding social responsibility, the enterprises have established and operationalized occupational health and safety management systems, which have obtained third-party certification. Furthermore, social, health, and safety management requirements have been integrated into the evaluation system for key raw material suppliers, with regular assessments conducted. Additionally, through multi-level training and cultural advocacy, the enterprises have incorporated ecological and social responsibility awareness into daily organizational practices, gradually building a sustainability mechanism involving full participation.

These systematic adjustments and cross-dimensional actions demonstrate that the pilot enterprises have transitioned from commitment to practice, initially forming an integrated transformation pathway that synergistically advances environmental, biodiversity, and social responsibility objectives.

5.2 Partner Feedback

All three pilot enterprises stated that the indicator system covered by this technical specification is systematic, comprehensive, and scientific, not only providing a clear implementation path for enterprises' green transformation but also aligning with their long-term sustainable development strategies.

HLA Group pointed out that the technical specification is highly consistent with its full-chain green strategy, and the carbon footprint accounting requirements in particular provide a quantitative basis for formulating emission reduction plans. **Baoxiniao** believes that the technical specification connects international concepts while taking into account the actual situation of domestic industries, providing operable specifications for green manufacturing practices. **Shanghai Baoniao** stated that the technical specification is highly compatible with its intelligent green factory operation model, effectively improving the systematization and standardization of production management.

Overall, the technical specification has demonstrated strong guidance and driving effects in practical promotion, not only promoting the transformation practices of pilot enterprises but also injecting momentum into the future green development of the industry.

6、 Project Impact and Value Chain Reshaping Analysis

By integrating value chain analysis and a life-cycle perspective, the project has developed scientifically grounded ecological textile specifications, yielding preliminary impacts in several areas.

6.1 Impact on China's Textile Industry

The technical specification developed by this project, structured around the value chain and framed by a life-cycle approach, offers enterprises

systematic guidance for green transformation spanning from raw materials to end-use. This has effectively strengthened their environmental awareness and management capabilities. Specifically, it has supported pilot enterprises in formulating carbon reduction pathways and integrating green transition principles into their development strategies. Furthermore, through multi-level awareness campaigns and demonstration via pilot cases, it has elevated understanding of ecological textiles among stakeholders across the textile value chain, laying a foundation for industry-wide consensus. This technical specification serves as a comprehensive standard that integrates multi-dimensional requirements including human health concerns, climate change mitigation, biodiversity protection, pollution control, and social impact considerations. It enables small and medium-sized enterprises (SMEs) to achieve multi-dimensional compliance at both the organizational and product levels through a single certification process, significantly reducing the complexity of building a management system. In the follow-up phase of this project, we will also collaborate with testing institutions to launch a "Green Testing Support Package", effectively lowering the cost of testing for enterprises and making it easier for them to take the first step toward green transformation.

6.2 Analysis of the Reshaping Effect on the Value Chain

The technical specification has begun to shift focus toward environmental performance and responsibility transmission across the chain. **In Value Orientation**, it integrates ecological compliance and carbon performance into evaluation, promoting a shift from cost competition to green value creation. **In Segment Collaboration**, the life-cycle approach encourages extended management oversight from production to raw materials, use, recycling, and other links. **In Responsibility Transmission**, it advocates for pilot enterprises to drive performance improvements in their supply chains, fostering a co-governance ecosystem.

7、 Experience Summary and Future Outlook

7.1 Experience Summary

In the process of formulating, certifying, and promoting the eco-textile technical specification, this project has formed a set of systematic and replicable practical experiences.

First, emphasis was placed on concept leadership and methodological innovation. By introducing value chain and life cycle management concepts, a scientific and operable indicator system was constructed, enhancing the technical specification's systematic nature and guidance.

Second, adherence to the combination of standard leadership and pilot demonstration. Through technical specification interpretation, case sharing, and capacity building, industry awareness was effectively raised, attracting enterprises to actively participate. Visible examples formed through pilot enterprises strengthened the technical specification's persuasiveness and acceptability.

Third, establishment of a multi-stakeholder collaboration and whole-chain participation promotion mechanism. By integrating resources from certification bodies, testing units, industry associations, and industrial chain enterprises, a closed-loop collaboration system from technical specification development and technical support to enterprise practice was formed, effectively enhancing project implementation efficiency.

Fourth, proactive engagement with international platforms. Leveraging international platforms such as UNEP enhanced the international influence of the standard, boosting its recognition and appeal, thereby stimulating enterprise adoption willingness. Simultaneously, efforts were made to align the technical specification with international frameworks while closely integrating it with domestic industrial realities, providing enterprises with transformation guidance that conforms to global trends and is practically

feasible.

7.2 Future Outlook

Based on the existing achievements, to further promote the construction of a sustainable textile value chain, future efforts can be deepened in the following directions:

Firstly, deepening technical specification implementation and industrial connection. Track the industry's technological development and enterprise feedback, revise and improve the technical specification content in a timely manner to maintain its scientificity and applicability, ensuring that the technical specification always keeps pace with industrial reality and development frontiers.

Secondly, strengthening full-value-chain collaborative promotion. Continue to expand the scope of technical specification publicity and pilot coverage, provide guidance for more small and medium-sized enterprises, and help them establish the basic capabilities for green transformation.

Thirdly, enhancing international cooperation and experience sharing. Relying on international cooperation platforms, promote Chinese practice cases, deepen international exchanges and mutual learning, and contribute Chinese solutions to global environmental governance.